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ABSTRACT

This chapter reports the responses from four universities in Canada to an international questionnaire as part of a study to investigate the initiation and development of computer facilities in education. Data are presented under the headings: general development and scale of work, purposes of the project or unit, training of non-specialists and consultancy services, courseware development, and expectations of computer based learning. (VT)

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ONDERZOEK EN ONTWIKKELING VAN ONDERWIJS

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C.A. Hawkins

computer based learning 2

computer ondersteund onderwijs 4 Canada

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

IR005 377

a survey of the factors influencing its initiation and development

een onderzoek naar de factoren die de invoering en ontwikkeling van COO beïnvloeden

List of responding universities (4)

Simon Fraser University
Burnaby, B.C.
CAI Centre
S.K. Lower

University of Alberta, Edmonton
Division of Education Research Services
S. Hunka

Concordia University, Montreal
Sir George Williams Campus
G.M. Boyd
P.D. Mitchell
Loyala Campus
C.S. Kalman

McGill University, Montreal
G. Cartwright

I. GENERAL DEVELOPMENT AND SCALE OF WORK

Canada Table 1 Base of Operations

academic faculty		computer centre	committee	
4	- post-graduate ed. tech. program - chemistry dept. - ed.psych.dept. - faculty of education	--	2	- interdisciplinary committee Physics, Maths, Ed.Tech. - an advisory committee

Lower (Simon Fraser) contends that a CAI project's most favourable site is a Maths or 'hard' Science Department - the least favourable is an education or computing centre. 'Self-perpetuating organisations can be deadly!'

Hunka, describing the role of their advisory committee, says: 'we do not listen to advice from people who don't know what they are talking about. We do listen to our users.'

The reporting projects in Canada are for the most part sited in education/educational technology departments, and not subject to strict committee control. The interdisciplinary committee at Concordia coordinates a loosely knit group.

Canada Table 2 Main stimulus to establish units

administrative	staff initiative	other
1	5 -"by far the most important factor - people in our department"	3 -"general pressure of modernisation"

Lower reports stimulus from the computing centre, mainly (which adds interest to his comment in Table 1).

Canada Table 3 Main sources of innovative effort

administration	committee	faculty group		individual
		computer	education	
1: Computing Centre Director or Academic Vice President	1: multi-disci-plinary committee	-	2: - educational technologists with training in hard sciences - educational technologists	1: chemist

Canada Table 4 Staffing (Personnel totalled over all projects)

(exact numbers not given by all projects)

educational psychologists	educational technologists	computer scientists	lecturers	students/ gradual assistants
in 3 of the 4 projects	3 in 2 projects - research design, statistics and evaluation	in all 4 projects	- physics - maths - engineering - chemistry - social work - business - classics - geography	2- CAI programmer several from educational psychology

Totals cannot be given exactly, but it would seem that educational psychologists/technologists and subject matter specialists are roughly equally represented.

Canada Table 5 Direction of the Project

- Concordia's interdisciplinary committee, funded directly by the University President.
- Alberta's advisory committee for the overall operation of the Division. Priorities made essentially by the academic staff of the education division.

The other projects are administered by CAI centre directors, one in a Chemistry Department, the other cross-appointed to education development services.

Canada Table 6 Main types of resistance

	Yes	No	Comment
Cost	2	3	- not a problem; computer-time free for educational use - but further developments will be affected by cost - not yet overcome! hardware mainly from research grants to individuals in the group
Lack of knowledge, lack of confidence	2		- until it is tried!
Inertia	4		- significant few feel any need to alter present techniques
Lack of time for reconstructing courses	3		- too busy maintaining present system
Lack of time to learn new techniques	2		

Canada Table 6 (continued)

Hunka contends that difficulties are overcome by developing full length courses which the instructor supports rather than vice versa. The advantages to the instructor are then appreciated, and resistance drops.

Canada Table 7 Main sources of resistance

	Yes	No
Costs	2: dollars currently needed first to meet salary settlement	
Higher priority of other projects	1: teaching comes a poor third to administration and research	1: administration was encouraging. A good presentation overcomes obstacles
other pressures on teachers	2: most of the problems are here. the main role of a teachers is to teach himself	
anxiety of displacement	1: by small number less able instructors	

Canada Table 8 Obstacles to teacher cooperation

	Yes	No
learning computer language	2	1: not important
learning to construct self-instructional package	4: -most have no experience in this -they have no idea what is involved, or -how long it takes	
no incentives	3: -no reason to change what they are doing	
no training	1	1: most not interested
other	1: -fear of anything which may alter the balance of power and security	

Canada Table 9 Transfer

Use of materials before own courseware was develcped	Problems
1: detailed flow chart to be transcribed into computer language	- no technical problems - not good with class, only understood by students who already had the concepts
1: only small amounts	- some was of poor quality
others: No	- was successful on a small experimental scale - resources were inadequate, poor software

Canada Table 10 Use of own materials elsewhere

Scale	amount of adaptation needed	what success?
1: about 20 institutions	very little because CAI language uses a FORTRAN based compiler	no formal evaluation
1: about 35 institutions	very little	varying (CHEMEX/ ALCHEM programs)
Yes	- different equipment; we use graphics, light pens, c.r.t. , audio, film and many character sets	good as far as we know; not much feedback
No	-too much	

Canada Table 11 Now that the project has its own materials, to what extent are others used?

Only Hunka, Alberta, reports affirmatively.
Exchange of materials between Penn State and Alberta.

Others indicate:

- other institutions do not provide material that is easy to adapt
- there is a great problem in adapting to new hardware and software
- we have encountered little up to the required quality standard

The amount of adaptation respondents would be prepared to make was minimal, unless the materials were of outstanding quality.

Canada Tables 12/13 Length and stability of establishment

Initiation

2 projects started with particular instructional problems:

- physics and calculus were concurrent courses, but calculus was needed from the beginning of the physics course. CAI gave an introduction.
- a 30 hour program in cardiology demonstrated that CAI can take over as a primary source of instruction

1: continued own research interest following Ph.D.

1: associated with an educational technology course.

Life Expectancy

Permanent	1 project is permanent - attached to a graduate program in educational technology
Pilot	1 well beyond pilot stage, hoping to establish permanent centre 1 pilot, but with long life expectancy as many courses now depend on the system Lower's project is proudly permanently dis-established.

Canada Tables 14/15/16 Materials available and usage

	No. of 'lessons'	subjects	level	other computer administered material	hours
Concordia (Kalman)	3 fully tested			computer simulation of a classroom	
(Boyd)	several dozen	one complete FORTRAN course. psychology course units maths, statistics, physics, typing, and industrial topics (TV wiring etc.)		2 test batteries for Calculus and Physics	2000 a year
Simon Fraser (Lower)	100 modules, 20 topics 30 modules 4 lessons	chemistry maths English	2^y 3^y 2^y 3^y		10-50 hrs/ student/semester
Alberta (Hunka)	30 hours 40 hours 22 hours 70 hours 30 hours 20 hours 15 hours 50 hours	cardiology special education CARE introduction to CAI programing statistics French fundamentals of data processing patient simulations electrical theory	3^y 3^y 3^y 3^y 2^y 3^y 3^y 3^y	Test bank Electrical theory	22,000 student terminal hrs. per year
McGill (Cartwright)	25	Quebec School Law Educational Psych. Classics	3^y 3^y 3^y	5 Educational Psychology Tests	77,000 terminals hours per year

Canada Table 17 Factors contributing most to success

Within the project

technical	1: - the initial availability of 10 computer terminals and access to a computer 1: - existence of a large time-shared computer system with spare capacity, which runs in a reliable manner
organisational/ sociological	1: - teachers interested in innovative teaching 1: - enthusiasm and dedication 1: - close cooperation of a group with wide range of educational and computing skills 1: - not restricting developments to one 'learning theory' approach

Outside the project

1: - a helpful administration

1: - success of courses with CAI as a major source of instruction

1: - students are enthusiastic, and are willing to come to the centre at all hours (it is open Saturdays, Sundays, evenings and usual study hours)

II.1, Canada Purposes of the Project or Unit

The reported objectives have been classified under the following headings, with an indication under each of the number of projects from which they have been drawn.

1. Research
2. Education
3. Technological
4. Implementation/Innovation

1. Research

(from 1 project)

1. to simulate an idealised student, and generate a class of students, for computer simulation of a classroom;

2. investigate instructional planning decisions;

2. Educational

(from 1 project)

1. formalize procedures developed for performance analysis of students;

2. continually try to improve courses;

3. Technological

(from 2 projects)

1. develop CAI authoring techniques, including interactive graphics techniques;

2. establish a new system with remote capability;

4. Implementation/Innovation

(from 2 projects)

1. design the best possible instructional materials without compromising it to the limitations of inadequate languages;

2. demonstrate effective ways of incorporating CAI into other aspects of a course;

3. increase use of computer workspaces;

II.2 Canada How were the objectives arrived at?

Clearly, informally.
There is only one response: "personal opinion".

II.2b Canada Which of the objectives reported are considered to be of most importance?

1: Research
2: Technical: - development of CAI authoring techniques, including interactive graphics languages;
1: Demonstration
1: Production

II.3 Canada Rated importance of suggested reasons for developing computer based learning

Key: high - rated 1-3
medium - rated 4-6
low - rated 7 or below, or not checked at all by projects responding to other suggested comments

III.3 Canada

Rated importance of suggested reasons for developing computer based learning

	high	medium	low	comment
research on student learning	3	2	1	- in the long run, CAI will provide the best way of studying student learning
individualization of instruction	3	2	1	- more important to the students than the instructors
mastery learning	3	2	1	- particularly for technical students - just CMI
evaluation of course elements	-	4	2	- automatically assumed for CAI courses, but not for regular courses
effecting organisational change	-	1	5	- a slow process over which we have no control - for this, computer games and computer conferencing are more effective
increasing capacity of educational provision	1	3	1	- to meet 'peak' or 'trough' demands
increasing teaching effectiveness	3	1	-	- hard to do by CAI - particularly remedial, school levels
decreasing student's learning time	2	-	2	- CAI may increase time-hopefully, students learn more - yes, but student's time means nothing to us in dollars - very important
decreasing teacher's teaching time	-	2	2	- CAI will increase teacher's time - only at the expense of a proper commitment to preparation
decreasing teacher's record keeping time	-	2	2	
other	1			- facilitating thinking about learning and teaching on the part of faculty

Research on student learning is ranked higher here, and there is more importance attached to reducing the learning time of students.

As with the other countries surveyed, individualisation of instruction is ranked high, organisational change low. The first supplementary comment is probably of general validity, and does much to explain why this is the case.

Little hope is offered - or importance attached - to decreasing the load on teachers. CAI is regarded as a quality product, enriching the curriculum, rather than providing an answer for anything other than quite exceptional bottlenecks and shortages.

IV. Canada — Training of non-specialists and consultancy services

IV.1 Canada — Courses

	Yes	No	Comment
Courses in author languages	2		- course on CAI system, 15 hrs, 5 students per year - course in graduate school through the center for instructional technology, about 150 hours formal study
courses in instructional design	2		- courses for undergraduates
advice and consultation for beginners	3		- 5-6 continuously as required - continual informal contact with others

IV.2 Canada — Further consultancy

a. problems of computer implementation

- yes
- 2: within available recources

b. problems of instructional design

- 2: yes, but cautiously since an author in another discipline can claim we don't know his subject matter
- within available resources

c. evaluation

- 2: yes, extensive programs have been developed
- within available resources

V. Canada — Courseware Development

V.1 Canada — Decision Basis for Topic Selection

a. Who decides?

All four projects respond - the teachers.

b. Criteria?

- the motivation and interest of the teacher concerned
- whether the system facilities will be fully utilised, and the topic can be handled effectively as the instructor views it

V.2 Canada — Who constructs the packages?

(some multiple responses)

	number	comment
teachers plus specialists	3	- specialists from our unit
teachers alone	3	- in most cases - sometimes a pair of instructors
teachers plus graduate students	2	

V.3 Canada — Who sets the Package in Courseware?

3 projects respond 'As in 2'.

1 project- 'some instructors do it themselves, otherwise someone in the unit does it')

V.4. Canada — Courseware evaluation

Who evaluates the courseware developed?

- 2 projects respond : the instructor
- 1 project : teachers don't appreciate that it is necessary, so it's a problem. Unit has set up a system (described below) but only 3 programs to date have been through it (Concordia)
- 1 project : students, via faculty
- 1 project : no response

How?

- 1 project : mostly informally (Cartwright)
- 1 project : study of student performance records
- 1 project (Concordia) :
  1. continuous testing on students, plus student interviews, during development
  2. full-scale in-class testing with control group
  3. evaluation and revision
  4. refinement during regular use

With what result?

- 'Poor. We are hoping to establish more formal procedures.'
- Course modification. Many alterations before optimal is reached.

VI. Canada — Expectations of computer based learning

VI.1. Canada — Configuration

	the four responding projects			
big stand-alone (CAI-dedicated or mixed)	10%		for some	
stand-alone dedicated in mini or micro	25%	but with provision for network call-up	for some	difficult to predict - room for all 3, depending on application. Minis will increase
networks	65%	with intelligent terminals	will come slowly - networks not always sufficient reliable	

VI.2 Canada — Terminals

	Yes	Possibly	No	Comment
Paper	-	3	2	- obsolete - only on demand
V.D.U.	4	-	-	- until plasma cheaper - about half with hard copy capabilities - with touch sensitive screens - will increase
Plasma	-	2	2	- debatable - t.v. technology may be more cost-effective - too difficult to produce - expensive, not enough flexibility
T.V.	2	1	2	- resolution of roster generated characters too low - probably colour CRT (as in TICCIT) most economical to produce - colour t.v. with 3 or 4 pages of memory

VI. Canada — Expectations of Computer Based Learning

VI.3 Canada — Software

	Yes	No	Comment
standard languages	1	2	- will continue - nil except for standard languages based computers - useless! too much work required
CAI languages	2	-	- will become simpler yet more sophisticated - NATAL
mixed development	3	-	- difficult to envisage, probably easier to have special purpose modular languages - each institution must have its own expertise and equipment, although a common language facilities course exchange

VI. Canada — Lesson style, development and interchange anticipated

VI.4 Canada — Style

	Yes	Possibly	Comment
test administration	5	-	- because it's easiest - will remain at current level
drill and practice	5	-	- most important because least effective, least interesting aspect of conventional teaching - will remain at current level
simple techniques	3	1	- will decrease
complex teaching	4	1	- will increase - plus simulation, gaming etc.
other	2	-	- information retrieval oriented CAI - student produced exercises for other students and mutual criticism of extension by students

Further Comment: - all techniques are used in a major course. One cannot write a 30-50 hour course only using one strategy.

VI. Canada — Lesson style development and interchange anticipated

VI.5 Canada — Development

	Yes	Possibly	Comment
Individual	3	-	- will start here - good teachers dedicate themselves to this like major text book authors - say 10%
Team	6	-	- will move to this stage next - there will be a lot of these, and they will produce a great deal of junk! - by groups of teachers with common interests plus special coordinator who has CAI as his administrative role - say 50%
Commercial Company	2	4	- limited - public school, not university - say 15% - probably, but it's a dismal prospect

VI. Canada — Lesson style, development and interchange

VI.6 Canada — Interchange

where?
- 2: where there is sufficient interest from teachers, with materials with large potential audiences;
- 1: on line within a metropolitan area;

how?
- established reportory of material with proper documentation standards. Educational institutions have had 5 years of budget cuts.
- mostly by informal contacts, later by commercial publishers;
- further abroad than metropolitan area, by tape or disk;

VI. Canada Commitment and further free comment

1: events are moving so rapdily in the computer realm, it is difficult to speculate;

2: I expect to continue in CAI as an author;

1: work on evaluation/revision cycle needed;

1: simulation of educational system, education gaming;